

Stave Program Overview and Electrical

Carl Haber

Presentations

- Overview and Stave Electrical: this talk
- Stave Mechanics + support: Gil
- Support +stave mechanics: D.Lynn
- Robotics: P.Tipton

Outline

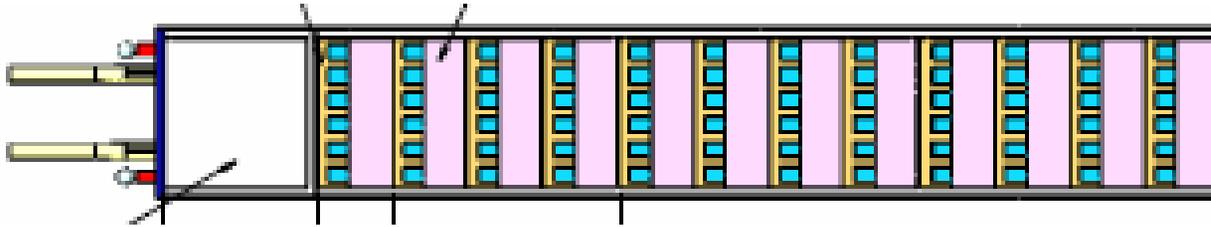
- Where we are in FY07
- Plans for the remainder of current program
- Plans for FY08
- Budget

2006



60 cm
6 modules

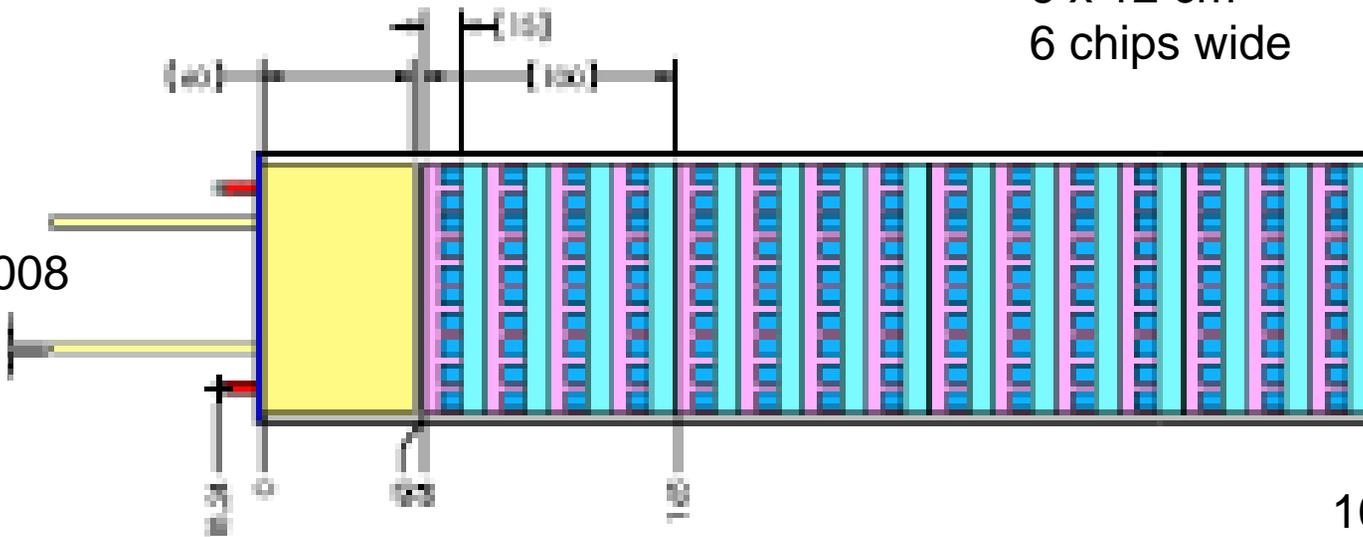
2007



6 x 12 cm
6 chips wide

1 meter,
Double sided,
3 cm strip,
30 modules/side
192 Watts
2.5 % Xo

2008



1 meter,
Double sided,
2.5 cm strip,
40 modules/side
400-450 Watts ?

10 x 10 cm
10 chips wide

Concerns:

- Increased mass in cooling system
- How do serial powering increments divide up appropriately for very large modules? Need to avoid excessive currents.

Where we are in 2007

- Stave measurements **LBL, BNL (with RAL)**
 - 6 module/side + ABCD vehicle (Run2b sensors)
 - Serial powering
 - Optical (UCSC)
 - New DAQ system
- Stave prototypes **LBL, BNL**
 - Thermal and mechanical simulations
 - Design of electrical components
 - Design and test of mechanical components
 - Plans for next version (2008 stave)
 - Detectors
- Robotic assembly of staves **Yale, LBL**
 - Steps and tasks
 - Investigation of hardware options
- Mechanical support **BNL, LBL**
 - Endplate + tube design
 - Cylinder + ring design

FY 2007 Highlights

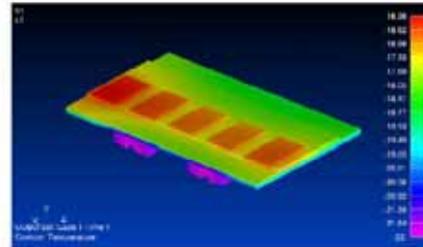
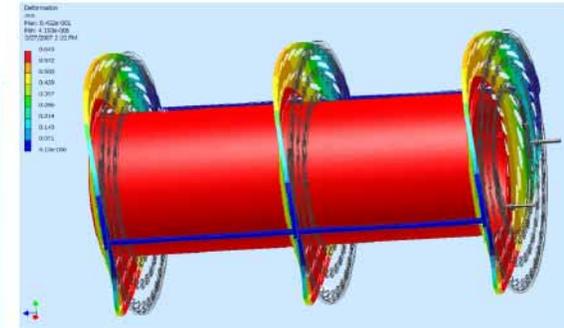
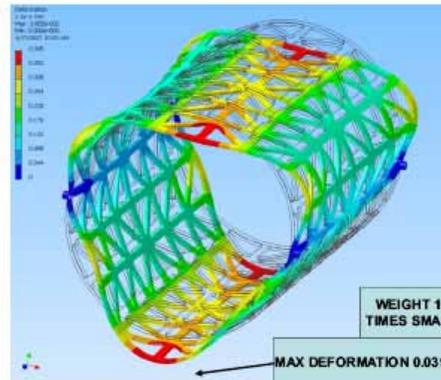
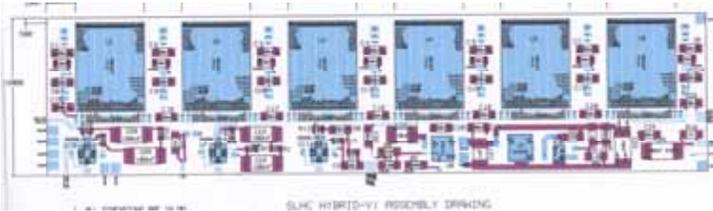
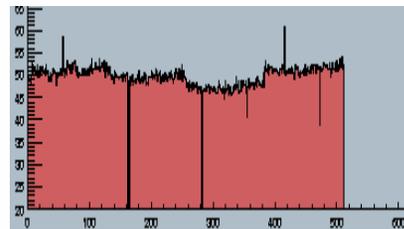
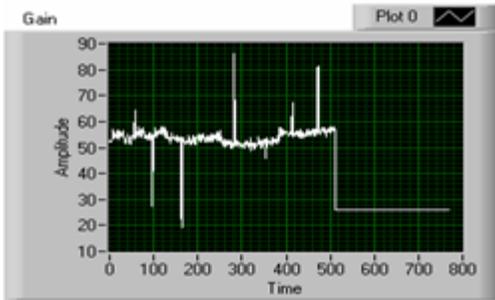
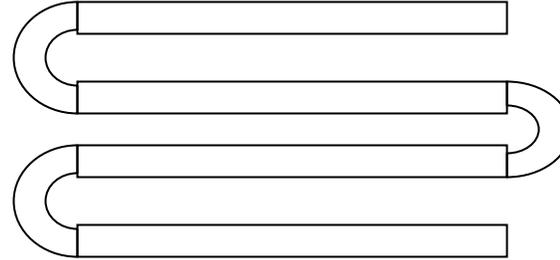
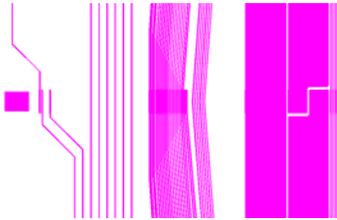


Figure 4: Thermal isolation for 18cm wide stave with Triple U-Tube cooling system.



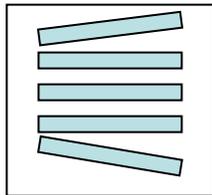
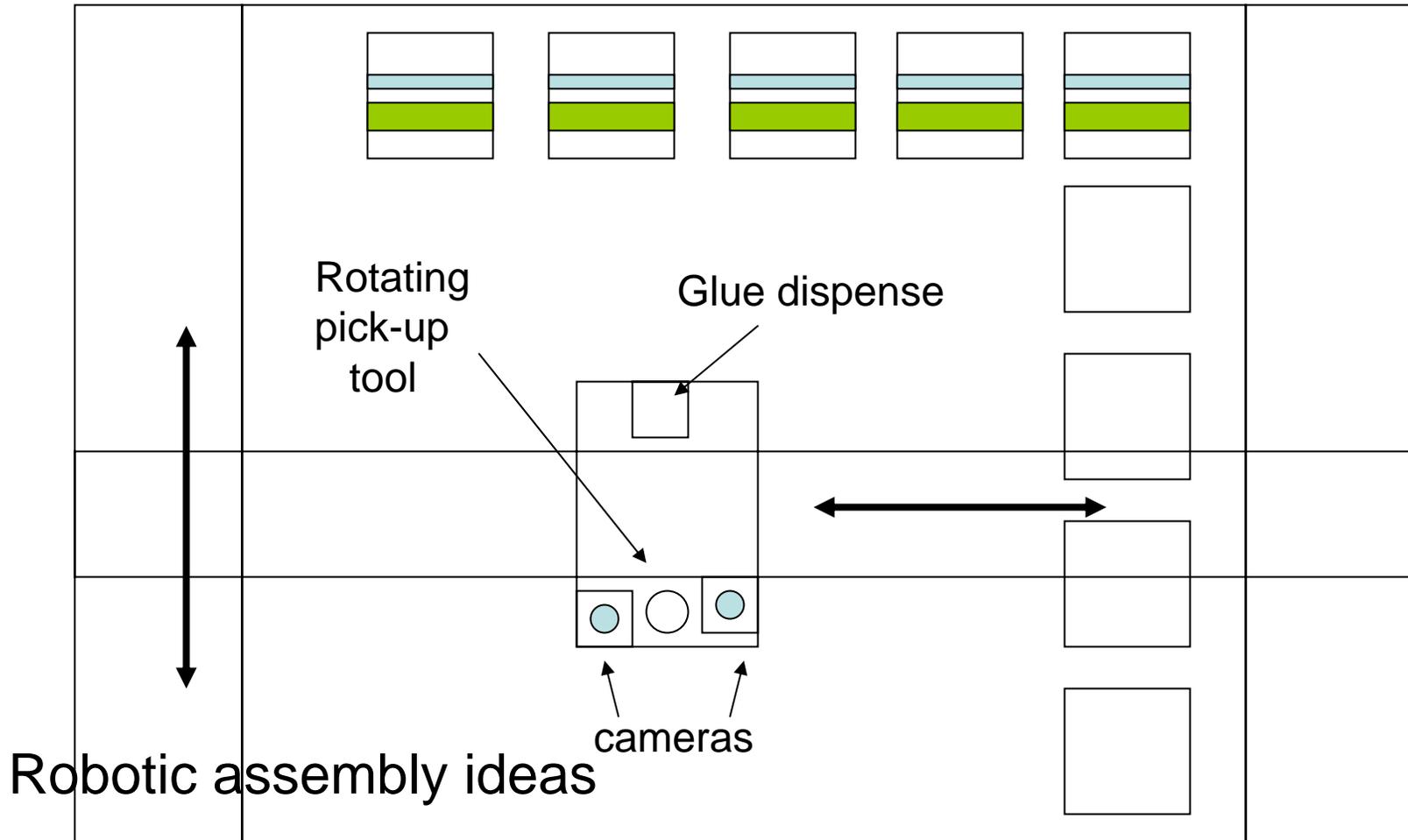
WEIGHT 1.07 / 0.468 = 2.29
TIMES SMALLER THAN SOLID

MAX DEFORMATION 0.039 mm

Plans for remainder of 2007 program

- Complete current bench measurement study
 - Further studies with new DAQ system
- Assemble and test 6 cm wide 2007 stave
 - Scale DAQ to 30 modules, faster CPU
- Design work on 10 cm 2008 stave
- Spec out robotic system
- Converge on mechanical support scheme
 - Endplates vs shells

1 meter Cartesian gantry with work head 5 x 5 detector cell



Plan for 2008

- Design and fabricate 2008 10 cm stave
 - Electrical components (relies on ABC-next)
 - Rough cost: \$300K for 3 staves built
 - Mechanical components
- Robotic assembly
 - Factorize elements, begin engineering on some aspects (glue, pattern recognition?...) Cost?
- Mechanical support
 - Prototyping (see following presentations)

Budget Request Overview

	materials	project labor	base labor	other
LBNL				
Stave Electrical	207	113	63	
Stave Mechanics	99	126	103	
Automation		20		
BNL				
Barrel-Stave Interface	1.5	51		
Barrel Mechanical	20	93		
Thermal-Mechanical Tests	1.1	64		
Stave Mechancs	8.2	58		
DAQ	5	56		
Power DC-DC	5.4	53		
Sensor Order	100			
Yale				
Automation	32	66	18	122
Grand Total	479.2	700		

4.1.4.1. Staves

Original FY07 Plan (Staves)

- Completion of FY2006 tasks
 - Complete testing of serial power “CDF style” stave. **DONE**
 - Complete DC-DC converter chip and board, test on a “CDF style” stave **NO**
 - Engineering studies on alternate powering reliability. **NO**
 - Complete mechanical studies leading the 1 meter stave design. **DONE**
 - Complete software development around NI-6561 module in preparation for multi-module tests. Test this new system. **DONE**
 - Test and QA on detector order when it arrives from Hamamatsu. **DONE**
- Design and build electrical components for the 1 meter stave
 - A six chip version of the ABCD hybrid with integrated serial powering circuitry will be designed and built. **DESIGN COMPLETE, READY to FAB**
 - A wider thin film fanout. **IN-HAND**
 - Test fixtures, holders, and interface cards. **IN DESIGN**
 - A 1 meter version of the bus cable. **IN DESIGN**
- Design and build mechanical assembly and test fixtures for the 1 meter stave. **DONE**
- Design and build electrical assembly and test fixtures for the 1 meter stave. **DESIGN**
- Fabricate stave (mechanically) and survey **SUMMER**
- Fabricate and test stave. Sufficient components will be to populate 3 staves. **SUMMER**

Additional Items

- The project evolved over FY07 which caused re-directions or reconsiderations of effort
- Liverpool meeting:
 - 10 cm wide stave introduced
 - Baseline converged around fully double sided design
- Interest in robotic assembly
- New DC-DC schemes (inductive)

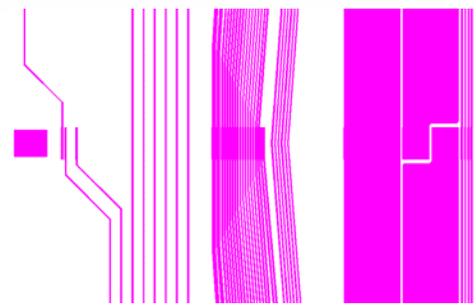
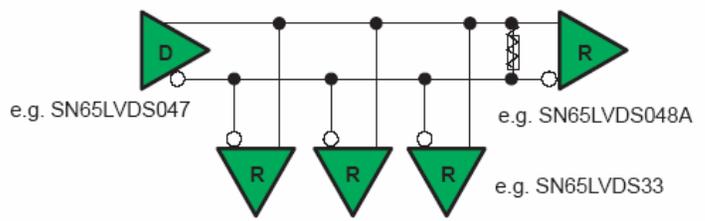
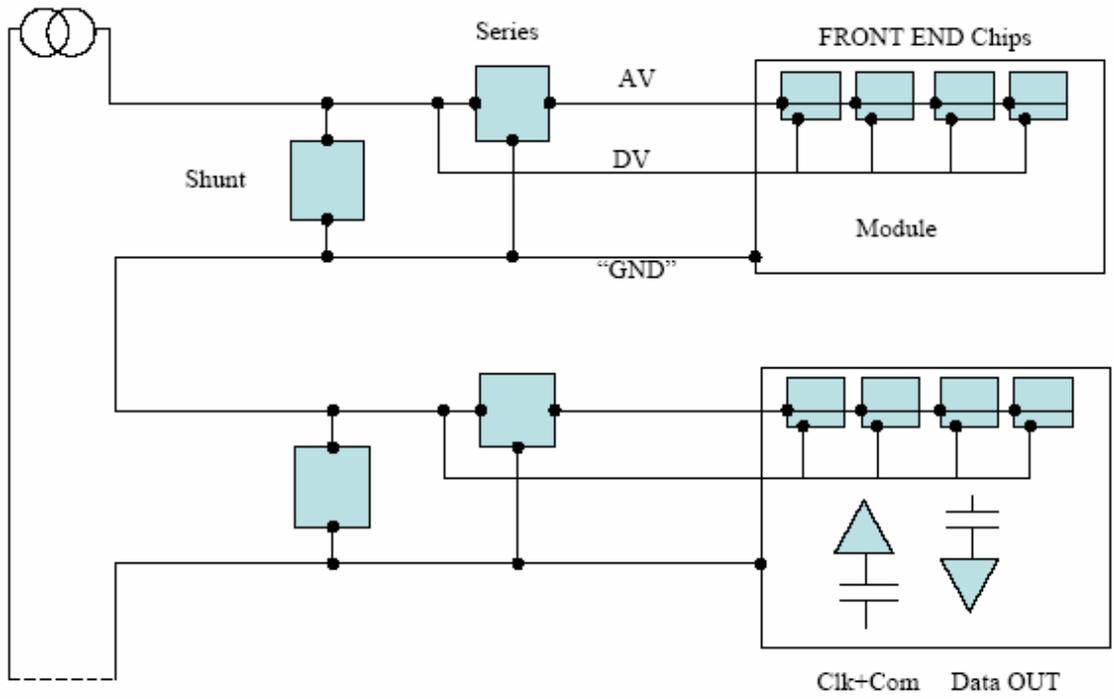
Technical Areas of Concern

- Moving performance targets: DS vs SS, overlap
- Increased channel counts
 - Power, mass, and cooling
 - Large alternative powering increments
- Lack of engineering effort on failure modes in alternative powering schemes
- Appropriate scales for prototyping

Stave Measurements

- See C.H. Hiroshima talk for details
 - Equality of results with/w'out serial powering
 - Parallel study gearing up at RAL
- DAQ system built for multiple modules
- Test upcoming with optical links
- IEEE NSS publication

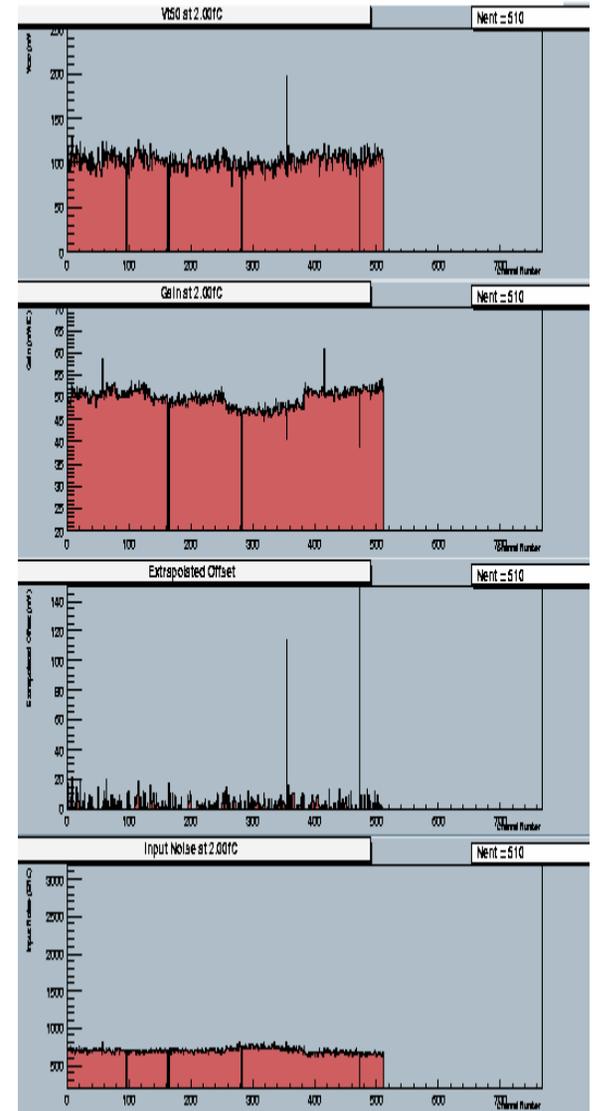
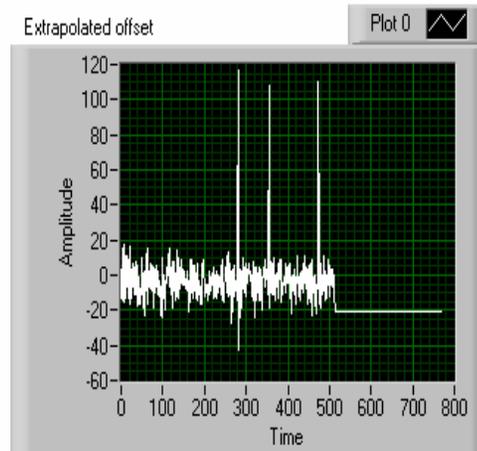
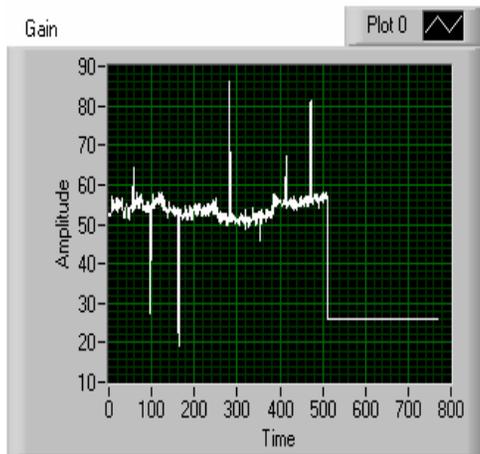
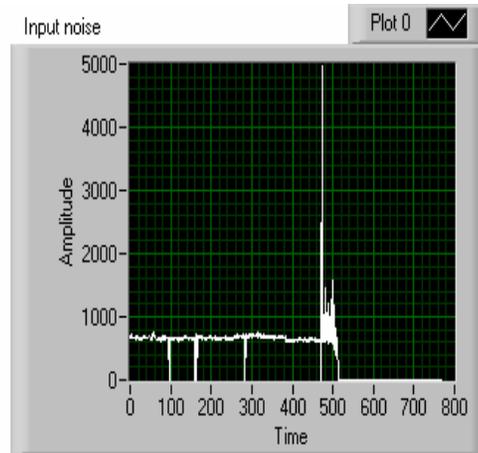
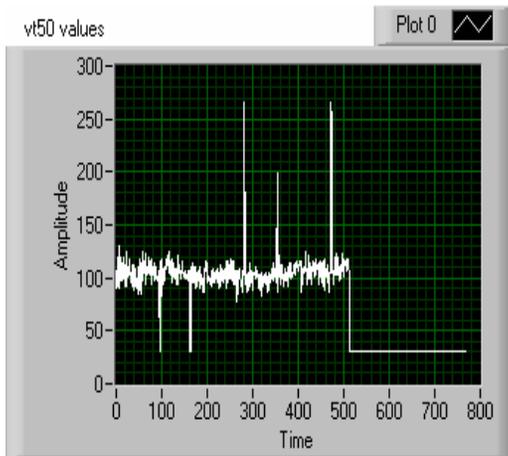
Serial Powering Configuration



New Stave Test DAQ

- Mustard system not well suited to readout of large numbers of modules
- Need bench top system easily configured for testing
- Use off-the-shelf DAQ cards from Nat.Inst
 - PXI-6561 16 channels of LVDS I/O
 - 160 Mbs system
 - Large amount of on-board memory/channel
 - No hardware histogramming
 - Program in LabView
- Systematic effort to add all the existing SCT tests – basically complete
- Configurable framework to handle any combination of components
- Reporting, data access, and comparison tools

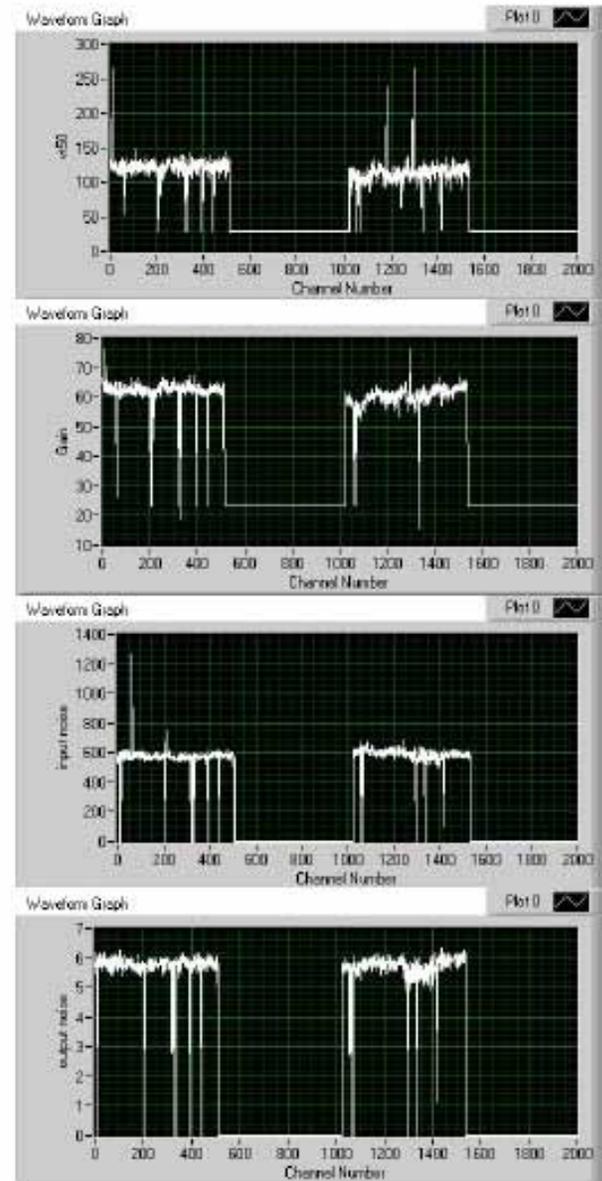
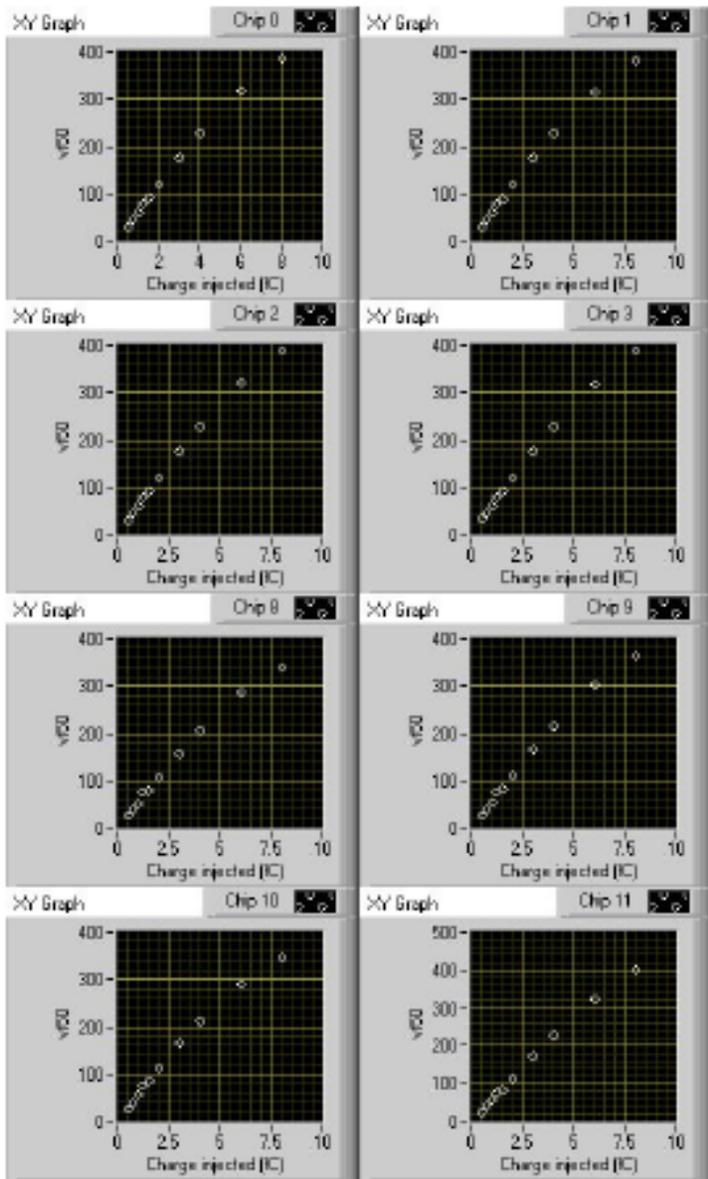
Are results consistent between two systems?

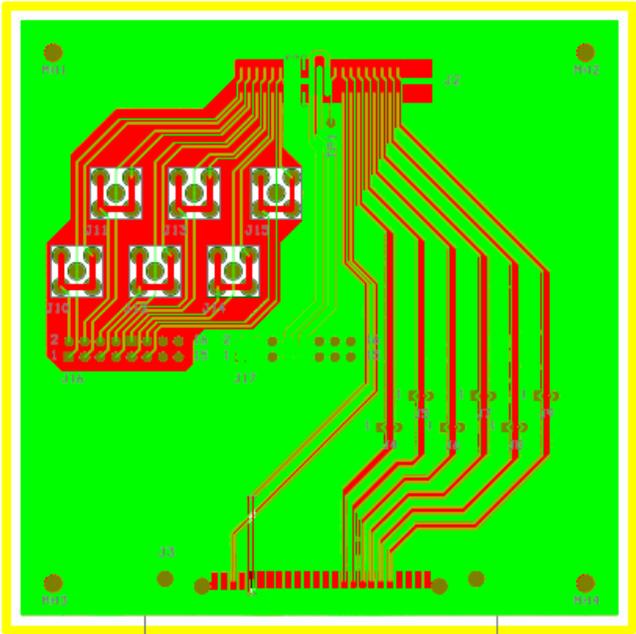
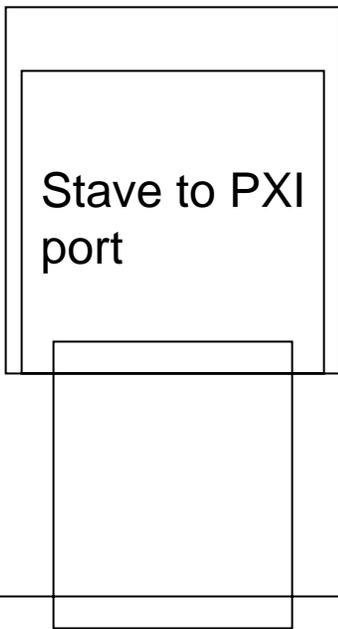
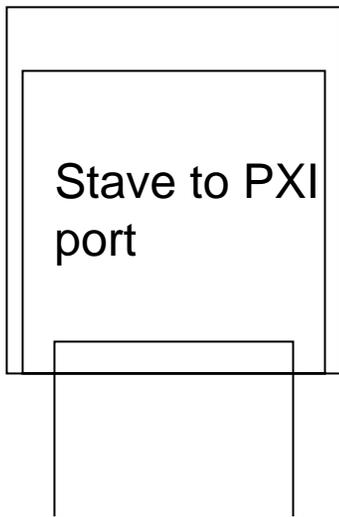


The values for the gain, input noise, vt50 values, and the extrapolated offset are consistent

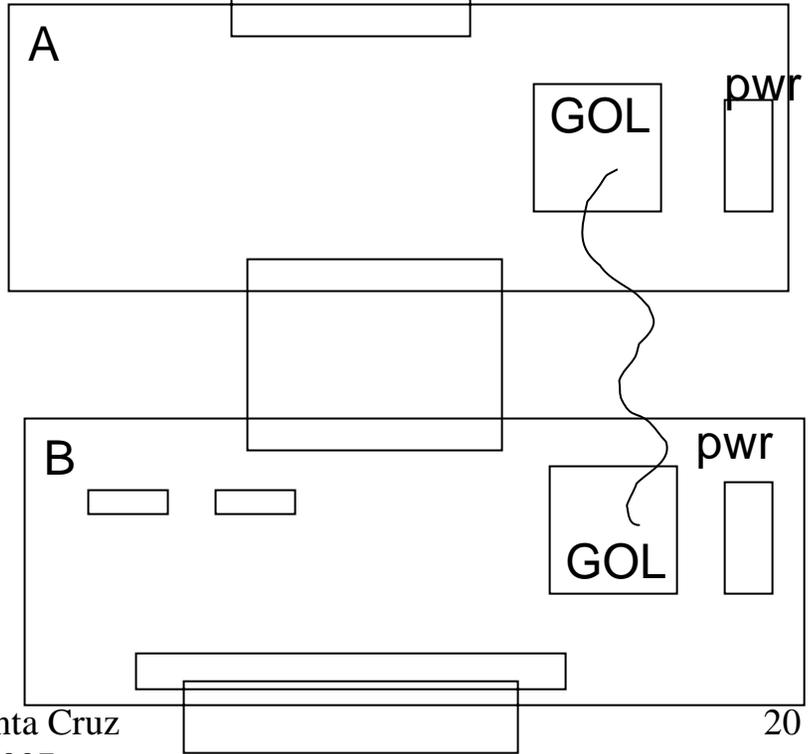
C. Haber: Santa Cruz
May 3, 2007

2 modules read out on a stave with new DAQ





Interface to PXI



Stave Prototypes

- Effort to fabricate a 6 cm wide, 30 module, DS, serial power
- Significant simulation and design effort complete (Miller)
- 1 meter components underway
 - Hybrid design complete
 - Assembly fixtures, fab + design
- New simulation & design effort on 10 cm wide
 - Cooling study, power distribution, specs

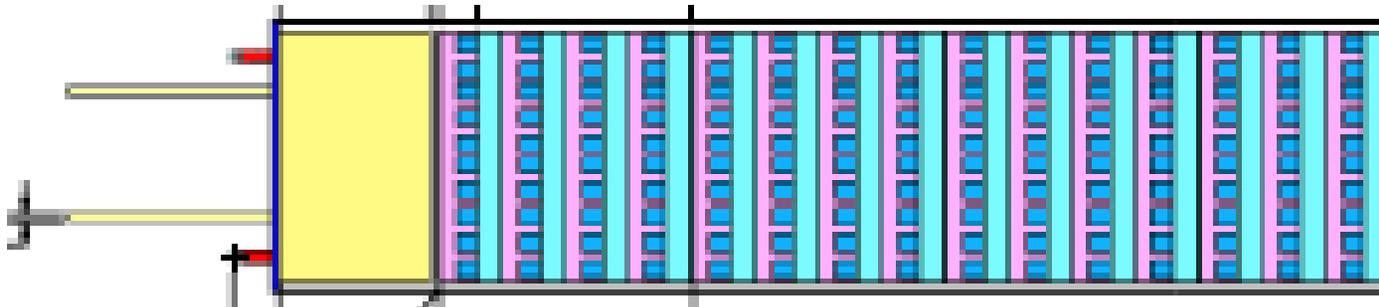
2007 Hybrid

- Thick film on BeO
- Layout includes serial powering
- Size = 63 x 15 mm, dominated by ABCD
- 2 month fabrication



4.1.4.1 Stave Electrical FY08

		material	project labor	base labor
4.1.4.1.1	10 chip ABC-next hybrid	\$177,000	\$25,800	
4.1.4.1.2	1 meter x 10 cm bus cable	\$8,500	\$10,000	
4.1.4.1.3	DAQ interface	\$1,500	\$2,500	
4.1.4.1.4	Stave electrical assembly	\$8,400	\$40,170	\$63,520
	student labor (testing)		\$35,000	
	totals (1.06 factor incl.)	\$207,124		\$63,520
	TOTALS	\$207,124	\$113,470	



Discussion of Budget

- Based upon assumption that 10 cm stave will be built
- 10 cm stave requires
 - ABC-next
 - Module controller/Powering chip
 - 10 x 10 detectors
- Driven by procurement, fabrication, and CAD